

A new species of *Prosopistoma* from the Malay Archipelago (Ephemeropt.).

By

M. A. LIEFTINCK

(Zoölogisch Museum, Buitenzorg).

With two plates.

Among the fresh water insects living in mountain torrents and hill streams of south-eastern Asia there are several forms whose structure is wonderfully adapted for life in rapidly running water, provided as they are with special adhesive apparatus with which to contend against the swift currents of water in such streams. The larvae of various species belonging to the beetle-families *Psephenidae* and *Dryopidae*, the early stages of the curious genus *Apistomyia* among the *Blepharoceridae* (Dipt.), the larvae and pupae of several Hydrocampine moths and a good number of *Trichoptera* and Mayflies should be especially mentioned in this respect.

Representatives of all of these have been found also in Java, but since many of the adult stages are still unknown, no definite identifications of these larvae could, therefore, be made.

Perhaps the most important discovery of that kind in Java is the larva of an unknown species belonging to the aberrant and much discussed Mayfly genus *Prosopistoma* — the famous "Binocle à queue en plumet" of GEOFFROY — which till the present was only known to occur in North and Central Europe, and Madagascar.

The European species of *Prosopistoma foliaceum* FOURCR. was discovered by GEOFFROY "dans les ruisseaux aux environs de Paris" (Hist. abrégée des Insectes, 1764). The short

description of his 'binocle' follows that of *Apus* (*Binoculus hemisphericus*). Later on, in 1785, FOURCROY described the curious animal of GEOFFROY as *Binoculus foliaceus*, and even LATREILLE, who created the generic name *Prosopistoma* to include both *foliaceum* and the nymph of a second species from Madagascar, called by him *variegatum*, placed it among the *Crustacea* (Nouv. Ann. du Museum d'Hist. Nat. t. II, 1833)¹⁾.

It was not until 1869 that EM. JOLY recognised the true systematic position of the animal, in the *Revue d. Soc. Savants*, 2, 5, 1869, the brief and insufficient diagnosis of the unique female subimago, finally bred from an Avignon larva, being published by the same entomologist, in collaboration with his father (2). Since then no further breeding experiments with this mysterious insect have been undertaken so that the adult stage still remains entirely unknown.

Were it not that our Javanese species had proven to be an exceptionally rare insect (we managed to secure only six specimens in all!) it would have been commendable to await the discovery of the final stage before giving it a name. To judge from appearances, however, this may last several months or even years and in describing this larva I propose to depart from the ordinary practice, viz. never to give a name to a larval type of insect, for the following reasons.

Firstly, the recognition of it as a new member of *Prosopistoma* is beyond doubt and it seems quite necessary to give it a name to facilitate future discussion upon it. Secondly, as this is only the second species of the highly remarkable genus known to exist in the world to-day the likelihood that the imagoes of the European *foliaceum* and the Javan species would prove to be not distinguishable, when they are at last captured, seems so remote that it may be reasonably ignored. And lastly, it seems practically certain that, if I refrain from naming it, after having described it, somebody else will certainly step in and do so, seeing that the precedent for naming of larval types has already been set up by the creator of the name *foliaceum*, adhered

¹⁾ As the larva of *P. variegatum* has never been described, the European *P. foliaceum* should stand as the genotype.

to the best known species, a name that has generally been adopted in spite of the unacquaintedness with the imago of even this insect.

Although I have not been fortunate enough to breed our species in the laboratory so far, it should not be impossible to carry out this breeding when using the cage aquarium with rapid running water as has been described by TONNOIR¹⁾. The two larvae captured on December 14, 1930, have been kept alive in the laboratory at Buitenzorg during 28 days, but owing to a derangement in the supply of conduct water both specimens were left to perish.

The genus, so far as recorded, seems to have a very wide and possibly discontinuous range of distribution. As we will see the Javan form represents a very interesting and distinct species with which I have associated the name of Miss WOUTERA van BENTHEM JUTTING, the able zoologist of the Zoological Museum at Amsterdam, who was the first to discover this very inconspicuous insect.

In this paper it is proposed only to discuss briefly the essential features of the external morphology of *P. wouterae*, in comparison with *P. foliaceum* FOURCR. More extensive and detailed experiments will be carried out as soon as opportunities are given and as soon as more material will come to hand. It is also intended to give full information on the habitations and biology of the larva in a special report to be published elsewhere.

***Prosopistoma wouterae*, sp. n. (Pls. 1 & 2).**

Closely allied to *P. foliaceum* FOURCROY, but possibly a smaller species. Material studied: — Six larvae, West Java, northern slope of Mt. (Goenoeng) Panggerango, ca. 1050 m alt., Tjisaroea Estate, in rocky stream of that name, Miss TERA van BENTHEM JUTTING and author coll. Type: — One larva (possibly full-grown), same locality, Aug. 10, 1930, in Mus. Buitenzorg. Paratypes: Two larvae (penultimate to the type), July 6, 1930; one larva (*idem*), Aug. 10, 1930; two larvae (*idem*), Dec. 14, 1930. All five specimens

¹⁾ Ann. Biol. lacustre, 12, 1923: 319—328.

topotypical and taken by the same collectors, in Mus. Buitenzorg.

Morphology of the larva.

Type measurements: total length of body (position of abdominal segments as shown on pl. 1 fig. 1) 3.7 mm. Width of thoraco-abdominal plate ("notal shield" or "carapax" of the authors) equal to its length on mid-dorsum, 2.00:2.00 mm. Greatest height of body, slightly before the middle of carapax, 0.77 mm. Width of head 1.0, length 0.5 mm. The paratypes are a little smaller; their measurements are: A. carapax 1.56:1.57; B. 1.60:1.64; C. 1.55:1.67 mm. Two examples not measured. For measures of other details of structure the plates should be consulted.

Characters of the genus. Extremely similar to *foliaceum*. The descriptions as offered for that species by EATON (1, pp. 149-150) in almost all respects is also applicable to *wouterae*. Apart from the distinctive features mentioned in the table below, some additional remarks upon both species appear not to be out of place.

The anterior portion of the head indicated by EATON as labrum + clypeus, in our species at least is single-jointed and evidently represents the labrum only (pl. 2 fig. 1). Rearward the true clypeus is well delimited from the epicranium by a complete, undulated suture, dividing the head into two unequal parts. On the clypeus are placed the median ocellus and the antennae, while on the much narrower epicranium the compound eyes and the posterior ocelli are situated (see also VAYSSIÈRE and LESTAGE, 6, pp. 78-79 and 3, pp. 177-178, respectively).

TRAGÅRDH, and long before him the JOLYS, have called attention to the fact that there are only five antennal joints in *foliaceum*, the second being the longest. This probably also holds good for our species, although the fifth joint is indistinctly two-jointed, the division lying just before the tip, in two specimens examined (pl. 1 fig. 3).

The lateral ocelli of *wouterae* are at least equal in size to the eyes, the median one being much smaller than the others. The base of the endopodite of each mandible is

preceded by a tuft of long puberulose setae, three in number (5—6 such setae in *foliaceum*). As in the latter species the maxillary palpi are only three-jointed (VAVSSIÈRE and EATON were wrong in counting four joints). On the other hand there seems to be some evidence of TRÄGÅRDH's interpretation of the mentum being incorrect; contrary to this the present writer has adopted EATON's views as embodied in the Monograph (*I*, p. 150, pl. 43 fig. 7—8). The legs are very similar in shape and size to *foliaceum*, the fore tibia, in about half of its length from the tip being armed interiorly with a row of spinulose or serrulate setae (cf. also EATON, p. 150, pl. 43 fig. 9—12). The tibiae are comparatively a little longer in our species than in *foliaceum*.

In *P. wouterae* the suture between meso- and metasterna of the thorax is entirely absent (*foliaceum*: "neither the artist nor myself could distinguish them in the subject of Pl. XLIII". — EATON, *I*, p. 149; „På den stora skölden märka vi, att den bakre spetsen är skild från den öfriga delen genom en svag sutur, som bildar en sammanhängande linje med gränsen mellan det 2 : dra och 3 : dje abdominalsegmentet" — TRÄGÅRDH, 4, pp 98—99, but not shown in his figure 8!).

In *P. foliaceum* there are three narrow rectangular plates on either side of the sternal plate, of which only the anterior one is demarcated all round by sutures, whereas the other two are open posteriorly and flanked by slightly raised lines. The anterior plate is said by TRÄGÅRDH to be an epimeron, the other two being interpreted as superficial structural adaptations to form resting grooves to the posterior two pairs of femora, when pressed close to the body. It should be noted, however, that in *wouterae* the anterior plate is neither bordered behind by a continuous transverse suture, nor does its raised interior margin touch the acetabulum of the second pair of legs (see pl. I, fig. 2). In the dissected type specimen of *wouterae* the small hind wing-buds of the future imago situated just dorsad and anterad of the first pair of tracheal branchiae, and covering the anterior portion of the latter, are well developed and not noticeably different in shape and size from those figured and described by

VAYSSIÈRE (6, p. 85, pl. 10, fig. 106). The circumstance that I have not succeeded in making out very clearly the outline shape of the future wings within their sheaths, leads me to suppose that the more advanced larva of our species has not yet reached the ultimate instar. (*P. foliaceum*: "A la fin du huitième stade de la vie larvaire... les fourreaux commencent à augmenter d'épaisseur, par suite du développement à leur intérieur des aîlès postérieures; ces aîlès achèvent de se former pendant la neuvième stade" — VAYSSIÈRE, 6, p. 85).

As in *P. foliaceum* the gill chamber of *wouterae* contains five distinct pairs of tracheal gills, the first and second pair being shown on pl. 1, fig. 5 and 6 of the present paper. The three posterior pairs of gills are entirely concealed by the large but extremely thin blades of the second pair, whilst the first pair of ramified gills are found attached just dorsal of the second. For differences in details of gill structure between *wouterae* and *foliaceum* VAYSSIÈRE's figures should be compared with those given here.

As was pointed out so very well by TRÄGÅRDH (4, pp. 100—101) on the ventral side only nine abdominal segments are discernible, and if the last visible segment be correctly interpreted as the tenth, his supposition of the first pair of tracheal gills representing a rest of the greatly reduced first abdominal segment, can possibly be ascertained.

On comparing the retractile cerci of the two species no noticeable differences in their structure could be traced.

The most striking marks of distinction may now be enumerated thus:

- | <i>P. wouterae.</i> | <i>P. foliaceum.</i> |
|---|--|
| 1. Head twice broader than long. | 1. Head not nearly twice broader than long. ¹⁾ |
| 2. Second antennal joint only little longer than joints 3—4 taken together. | 2. Second antennal joint about equal in length to joints 3—5 taken together. |

¹⁾ It may be well noted, however, that, when comparing EATON's and TRÄGÅRDH's drawings of this part of the body, the two figures differ widely in this respect!

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| <p>3. Second joint of maxillary palpi equal in length to first joint; second joint of labial palpi much shorter than first joint.</p> <p>4. Carapax of equal width and length (1:1), its anterior border only shallowly excavated, with the outer edges obtuse-angulate.</p> | <p>3. Second joint of maxillary palpi about one and a half times longer than first joint; second joint of labial palpi subequal in length to first joint.</p> <p>4. Carapax a little wider than long (from 1.2—1.38:1), its anterior border more markedly angulate with outer edges more pronounced.</p> |
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The measurements of the head of *P. foliaceum* are taken from VAYSSIÈRE's and TRÄGÅRDH's figures as the latter are probably the most reliable drawings.

Coloration. — The following interesting observations as regards the colours of the larva of *P. foliaceum* have been made by LESTAGE: "durant les mues intermédiaires, la coloration devient de plus en plus foncée, surtout sur la partie qui recouvre les ailes futures; quand le corps devient noirâtre, les contours de l'imago se voient par transparence" (3, p. 180).

The living colours of all our specimens of *P. wouterae* may be described as throughout bright chrome-yellow, marked on the upper side of the carapax with three more or less confluent, undulated, brown bands which are rather conspicuous during life but become effaced a little in spirit specimens. The shape of these markings is best understood when looking on the portrait of the entire insect, reproduced on pl. 1, fig. 1. Besides, the ocelli are not dark brown, as appears from that figure (drawn from an alcohol specimen), but are very clearly indicated in the living animal, almost pure white in colour, which gives the larva a striking appearance. The compound eyes are black and are well discernible through the dorsal shield.

Habitat and habits.

The Tjisaroea (*tji* = river, *saroea* = equal) in its upper course is a rather small, swiftly flowing mountain stream

with heavy stones in the bed. It comes down through a very damp region relieved by thick virgin forest. Owing to the great humidity at this altitude the stream contains always plenty of water, the heavy rainfall on the summit of Mt. Panggerango giving it numerous floods during the wet season months November to April, while during the four driest months of the year this part of the stream is dependent on an average number of 40-50 rainy days. Collecting was done on the lower portion of the stream, about two miles up stream from the point where the ravine opens out onto the small plateau of Tjisaroea Estate. In crossing an open sunny space of the streambed with large boulders and fast running deep water, the river enters the forest for a short distance over an almost plain surface of gravel and smaller stones.

It was here that on Aug. 14, 1930, we secured our first two individuals of *P. wouterae*. The stream then was low, most of the larger rocks being exposed and the water on the eddies and pools was scarcely more than knee-deep. The small larvae live in the rapids in mid-stream, harbouring (as stated also by EATON for *foliaceum*) in irregularities of the under surface of rough stones, and shunning the light. The only way to collect them is by turning over an immense number of stones, examining carefully the crevices in which the little animals remain attached by adhesion. When cautiously dislodged therefrom and put into a tube filled with water they swim around with agility, propelled solely by the caudal setae, holding their legs closely folded up under the body. We noticed that they always immediately retire under the shelter of stones or other objects lying on the bottom of the tube, and in sufficiently large aquaria without stones on the bottom they make vainless efforts to take shelter, drawing spirally twisted 'eights' and 'loopings' with the greatest ease.

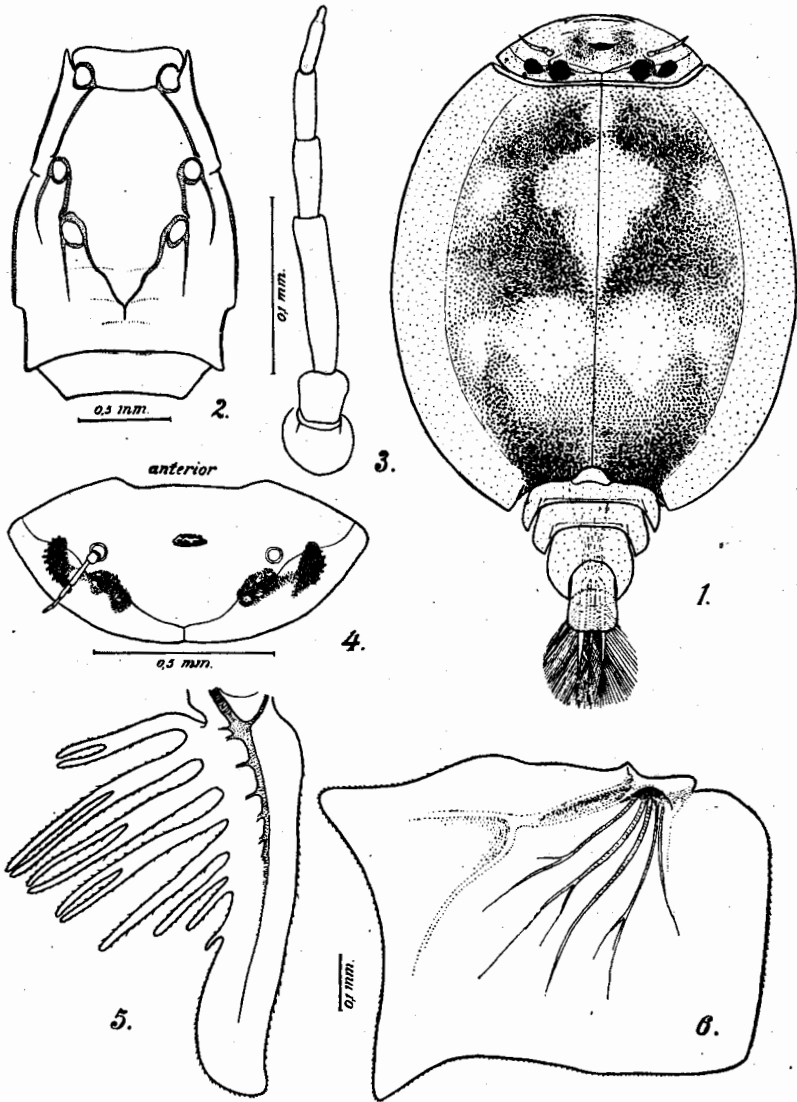
The amount of air dissolved in the water of the Tjisaroea is probably very high and certainly the water is much better oxygenated than that of the broader rivers in more level country. Accordingly, there is much evidence of *P. wouterae*

being restricted to the clear torrential streams at higher altitudes in Java.

In a future paper attempts will be made to combine all that is then known regarding the habits and early stages of the numerous insects inhabiting this rich and attractive mountain-stream.

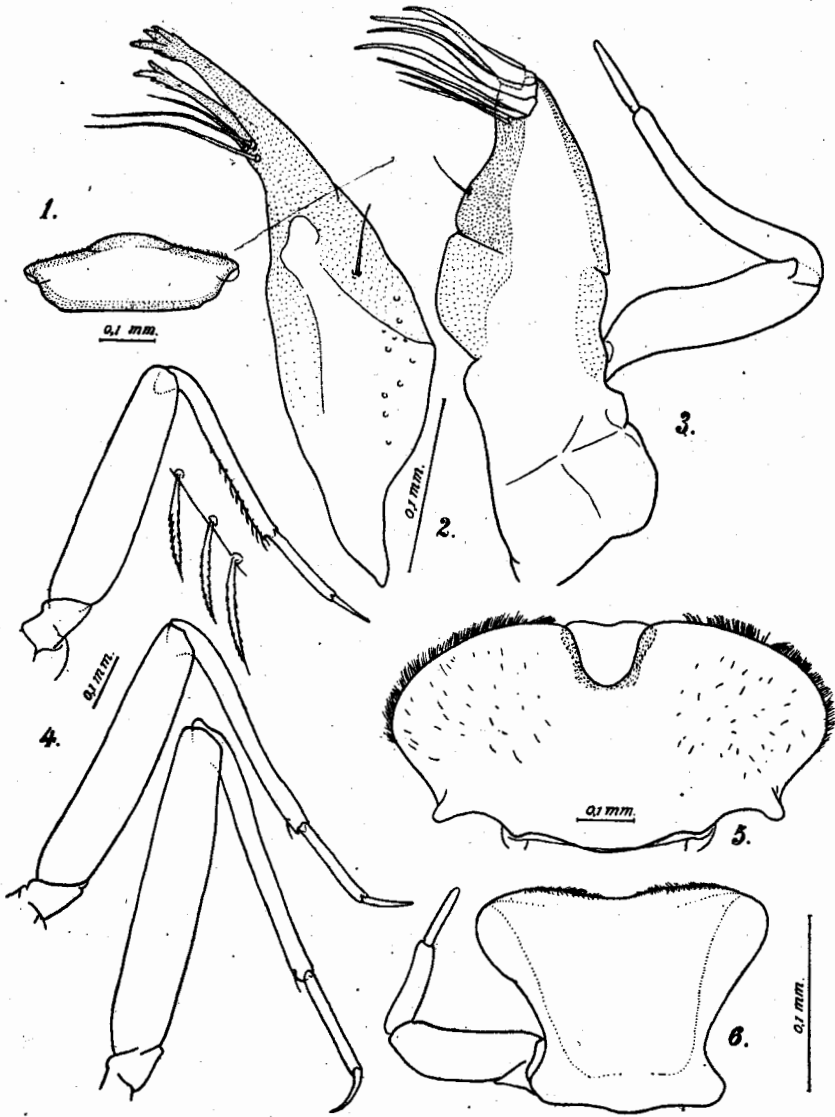
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M. A. L. del.

Prosopistoma woulerae LIEFTINCK, Java.



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EXPLANATION OF PLATES.

- Pl. 1. *Prosopistoma wouterae*, sp. n. — Larval structures.
- Fig. 1. — Dorsal aspect of possibly full-grown larva. Drawn from fresh spirit specimen, showing partly contracted caudal setae. (Type).
- Fig. 2. — Ventral aspect of thoraco-abdominal sternal plate, showing longitudinal side-ridges and sutures of abdominal segments.
- Fig. 3. — Left antenna, showing imperfectly developed sixth joint.
- Fig. 4. — Dorsal view of head (labrum omitted), showing left antenna, clypeal suture, ocelli and eyes.
- Fig. 5. — Dorsal view of first abdominal tracheal gill (right).
- Fig. 6. — Dorsal view of second abdominal tracheal gill (right).
- Pl. 2. *Prosopistoma wouterae*, sp. n. — Larval structures.
- Fig. 1. — Ventral aspect of labrum.
- Fig. 2. — Right mandible.
- Fig. 3. — Right maxilla (same scale).
- Fig. 4. — Ventral view of right fore leg (top), showing below serrulate setae, more highly magnified; intermediate leg (middle); hind leg (bottom).
- Fig. 5. — Ventral aspect of mentum + labium.
- Fig. 6. — Inner (dorsal) view of labium, more highly magnified.
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Overgedrukt uit het Tijdschrift voor Entomologie 1932,
Dl. LXXV. Supplement.